Speech Filter

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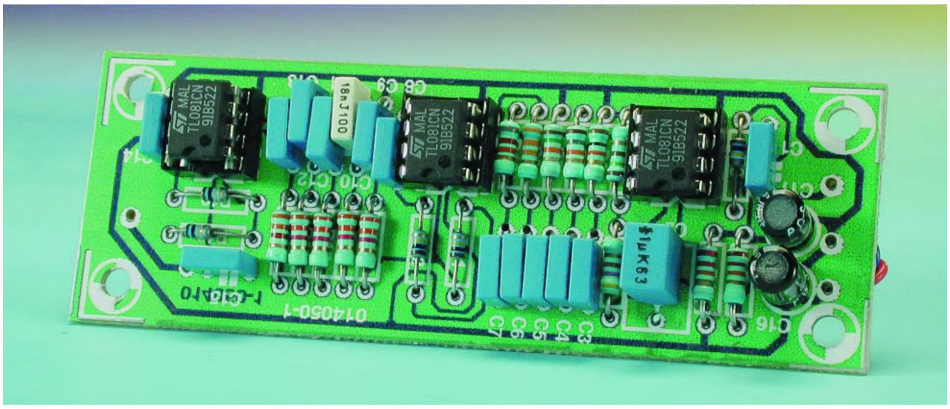

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In communications receivers and microphone amplifiers for transmitting equipment, there is frequently a need for a narrow, low-frequency bandpass filter that lets only the voice band through. This band is usually defined to be the portion of the audio frequency spectrum between approximately 300 Hz and 3300 Hz.

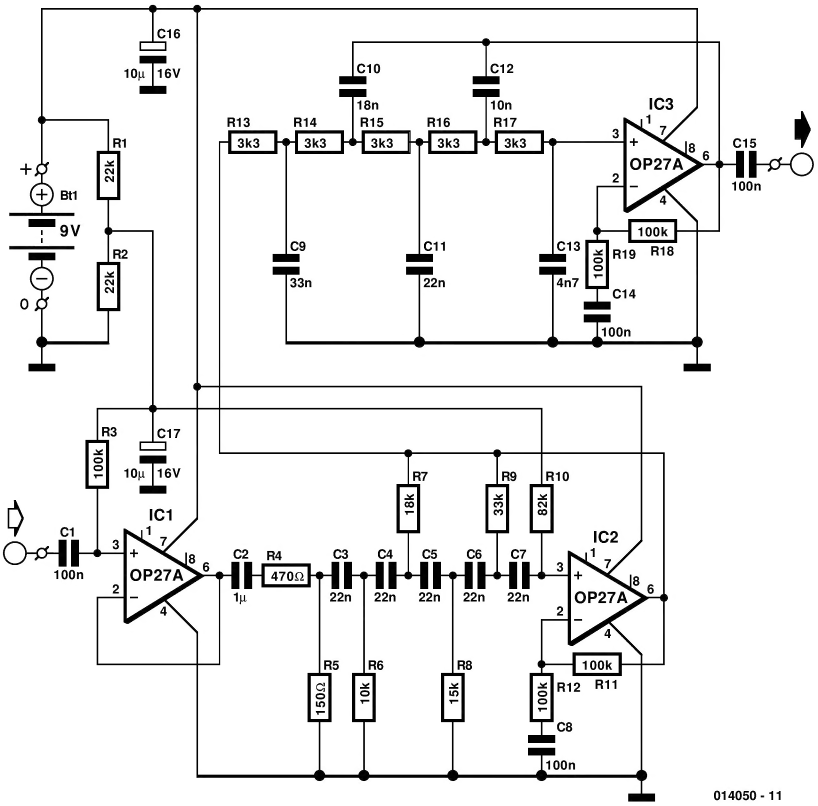
In order to implement such a filter, we have calculated the values for two fifth-order Butterworth filters having these corner frequencies and connected them in series. The result is a bandpass filter for the desired passband with a skirt steepness of 100 dB/decade.

The first opamp (IC1) acts as a buffer. The circuit can be powered by a unipolar supply voltage between 5 V and 18 V, which is a broad enough range that it should always be possible to find a suitable voltage when building the filter into existing equipment. The current consumption of the filter is only a few milliampères, which should rarely pose a problem.

There is fairly wide selection of suitable candidates for the opamps, since the circuit is not critical in this regard. In addition to the indicated OP27A, you could consider using a TL081N or even an old-fashioned 741.

Due to unavoidable spreads in component values, the passband curve of the filter will never be completely perfect in actual practice. However, the deviations will be very small and in any case inaudible. In the passband region, the gain is approximately unity.

The printed circuit board design shown here allows the speech filter to be built in a very compact form, which can



COMPONENTS LIST

Resistors:
R1,R2 = 22kΩ
R3,R11,R12,R18,R19 = 100kΩ
R4 = 470Ω
R5 = 150Ω
R6 = 10kΩ
R7 = 18kΩ
R8 = 15kΩ
R9 = 33kΩ
R10 = 82kΩ
R13-R17 = 3kΩ3

Capacitors:
C1,C8,C14,C15 = 100nF
C2 = 1µF MKT
C3-C7,C11 = 22nF
C9 = 33nF
C10 = 18nF
C12 = 10nF
C13 = 4nF7
C16,C17 = 10µF 16V

Semiconductors:
IC1,IC2,IC3 = OP27A, TL081CN

Miscellaneous:
Bt1 = 9-V battery

be an important factor if it must be fitted into existing equipment. You can quickly check the fully assembled circuit by momentarily measuring the voltages at the inputs and outputs of the three opamps. Half of the supply voltage should be present at all of these locations.

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